IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Jeffrey Tarvin

Serial No.: 10/711,918

Filed: October 13, 2004

For: System and Method to Interpret Distributed Temperature Sensor Data and to Determine a Flow Rate in a Well

Group Art Unit: 3676

Examiner: DiTrani, Angela M.

Atty Docket: 101.0166

Assistant Commissioner
for Patents
Washington, D.C. 20231

CERTIFICATE OF MAILING
37 C.F.R. 1.8

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June 15, 2009	
Date	Robert A. Van Someren

Assistant Commissioner:

APPEAL BRIEF PURSUANT TO 37 C.F.R. §§ 41.31 AND 41.37

This Appeal Brief is being filed in furtherance to the Notice of Appeal mailed on April 23, 2009 and received by the Patent Office on April 27, 2009. Appellant would like to thank the Examiner for agreeing with Appellant's arguments in the original Appeal Brief filed July 30, 2008 and for withdrawing the rejections which had previously been consistently applied. However, Appellant questions the January 26, 2009 attempt to reopen prosecution by presenting 17 different claim rejections - after four and a half years of prosecution involving the expenditure of substantial time and money in prosecuting the present application. As discussed in greater detail below, Appellant once again believes the rejections are not supported and should be withdrawn.

1. REAL PARTY IN INTEREST

The real party in interest is Schlumberger Technology Corporation, the Assignee of the above-referenced application by virtue of the Assignment recorded at reel 015241, frame 0832.

2. RELATED APPEALS AND INTERFERENCES

The present application was previously appealed on July 30, 2008. Subsequently, an Office Action was mailed on January 26, 2009 to reopen prosecution, and the present Appeal has been initiated in response. Appellant is unaware of any interferences related to this Appeal. The undersigned is Appellant's legal representative in this Appeal. Schlumberger Technology Corporation, the Assignee of the above-referenced application, will be directly affected by the Board's decision in the pending appeal.

3. STATUS OF CLAIMS

Claims 12-13, 32-33, 42, 49-94 have been canceled without prejudice, and claims 1-11, 14-31, 34-41, 43-48 stand rejected by the Examiner as noted in the January 26, 2009 Office Action mailed after the original Appeal Brief. The rejection of claims 1-11, 14-31, 34-41 and 43-48 is appealed.

4. STATUS OF AMENDMENTS

The November 27, 2008 Amendment (received December 3, 2007) was submitted prior to the Examiner's Final Rejection mailed March 6, 2008 and was entered by the Examiner. A response was filed on May 5, 2008 after final, but no amendments were submitted and no amendments were entered after the March 6, 2008 Final Rejection.

5. SUMMARY OF THE CLAIMED SUBJECT MATTER

a.) Independent Claim 1

Independent claim 1 is directed to a methodology for analyzing distributed temperature data from a well. *(See paragraph 9, page 7, lines 1-15).* The methodology uses a distributed temperature sensor system (20) for obtaining temperature profile data from a portion of a wellbore (12). *(See paragraph 20, page 10, lines 2-8).* The temperature profile data is provided

to a processor (22) which automatically determines whether fluids are flowing into or out of a tubing (16) located in the well based on processing of the temperature profile data. *(See paragraph 20, page 10, lines 2-3; paragraph 21, page 11, lines 2-11).* The methodology further comprises highlighting valuable information to a user related to the flow of fluid relative to the tubing (16). *(See paragraph 22, page 11, lines 12-20).*

b.) Independent Claim 10

Independent claim 10 is directed to a methodology for analyzing distributed temperature data from a well. *(See paragraph 9, page 7, lines 1-15).* The methodology comprises obtaining temperature profile data from a portion of a wellbore (12). *(See paragraph 20, page 10, lines 2-8).* The temperature profile data is provided to a processor (22) which automatically processes the temperature profile data. *(See paragraph 20, page 10, lines 2-3; paragraph 21, page 11, lines 2-11).* The processing of temperature profile data highlights valuable information to a user and further comprises applying a model-fitting algorithm to the data. *(See paragraph 22, page 11, lines 12-20; paragraphs 27-28, page 16, lines 11-20; paragraph 30, page 18, lines 10-20).* The processing also comprises constructing a match filter which includes incorporating modifications to the match filter to make it orthogonal to background trends. *(See paragraphs 53-57, page 34, line 2, through page 37, line 5).*

c.) Independent Claim 22

Independent claim 22 is directed to a system (10) used to analyze distributed temperature data from a well. *(See paragraph 9, page 7, lines 1-15).* The system (10) comprises a distributed temperature sensor (20) which measures temperature profile data along a portion of a wellbore (12). *(See paragraph 20, page 10, lines 2-8).* The temperature profile data is provided to a processor (22) in real-time. *(See paragraph 23, page 13, lines 1-6).* The processor (22) is programmed to identify a particular temperature signal that corresponds to a specific downhole event having an inflow of relatively cooler fluid. The processor (22) is further able to output valuable information related to the specific downhole event. *(See paragraphs 22-23, page 11, line 12, through page 13, line 6).*

d.) Independent Claim 31

Independent claim 31 is directed to a methodology that enables detection of certain events within a well. The methodology uses a distributed temperature sensor system (20) for obtaining

data related to temperature. *(See paragraph 20, page 10, lines 2-8).* The data is obtained from a portion of a wellbore (12) over a period of time. The methodology further comprises automatically processing the data to detect specific events related to heat energy in the well. Data also is automatically processed to determine a flow rate of fluid in the well. *(See paragraphs 70-76, page 42, line 20, through page 46, line 14).* The methodology further comprises displaying the results of the processing to a user. *(See paragraphs 23-24, page 12, line 11, through page 13, line 11).*

e.) Independent Claim 40

Independent claim 40 is directed to a methodology that enables detection of certain events within a well. The methodology comprises obtaining data over a period of time from along a portion of a wellbore (12). *(See paragraph 20, page 10, lines 2-8).* The data is automatically processed to detect specific events related to heat energy in the well. The automatic processing comprises applying a model-fitting algorithm *(See paragraphs 27-28, page 16, lines 11-20; paragraph 30, page 18, lines 10-20)* to the data which further includes constructing a match filter and using extrema of a convolution of the filter with data to select candidate depths. *(See paragraphs 53-59, page 34, line 2, through page 38, line 10).* Constructing the match filter further comprises incorporating modifications to the filter to make it orthogonal to background trends. *(See paragraphs 53-57, page 34, line 2, through page 37, line 5).* Additionally, the methodology comprises displaying results of the processing to a user. *(See paragraphs 23-24, page 12, line 11, through page 13, line 11).*

6. **GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL**

a.) Whether claims 1 and 21 are unpatentable under 35 U.S.C. § 102(b) as anticipated by the C.K. Woodrow (SPE/IADC 67729) reference.

b.) Whether claims 1, 6-8, 14, 21-26, 29, 31, 34-38, 46 and 48 are unpatentable under 35 U.S.C. § 102(b) as anticipated by the Brown reference (WO 01/04581).

c.) Whether claims 2 and 5 are unpatentable under 35 U.S.C. § 103(a) as obvious over the C.K. Woodrow (SPE/IADC 67729) reference in view of the Foster reference, US Patent No: 3,275,980.

d.) Whether claims 3 and 11 are unpatentable under 35 U.S.C. § 103(a) as obvious over the C.K. Woodrow (SPE/IADC 67729) reference in view of the Van Bemmel et al. reference, US Patent No: 6,201,884.

e.) Whether claim 4 is unpatentable under 35 U.S.C. § 103(a) as obvious over the C.K. Woodrow (SPE/IADC 67729) reference in view of the Charske et al. reference, US Patent No: 2,938,592.

f.) Whether claims 6-9 and 14 are unpatentable under 35 U.S.C. § 103(a) as obvious over the C.K. Woodrow (SPE/IADC 67729) reference in view of the Brown reference (WO 01/04581).

g.) Whether claim 15 is unpatentable under 35 U.S.C. § 103(a) as obvious over the C.K. Woodrow (SPE/IADC 67729) reference.

h.) Whether claims 16-20 are unpatentable under 35 U.S.C. § 103(a) as obvious over the C.K. Woodrow (SPE/IADC 67729) reference in view of the Brune et al. reference, US Patent No: 6,756,783.

i.) Whether claims 10 and 40 are unpatentable under 35 U.S.C. § 103(a) as obvious over the C.K. Woodrow (SPE/IADC 67729) reference in view of the Brune et al. reference, US Patent No: 6,756,783.

j.) Whether claims 2 and 5 are unpatentable under 35 U.S.C. § 103(a) as obvious over the Brown reference (WO 01/04581) in view of the Foster reference, US Patent No: 3,275,980.

k.) Whether claims 3 and 11 are unpatentable under 35 U.S.C. § 103(a) as obvious over the Brown reference (WO 01/04581) in view of the Van Bemmel et al. reference, US Patent No: 6,201,884.

l.) Whether claim 4 is unpatentable under 35 U.S.C. § 103(a) as obvious over the Brown reference (WO 01/04581) in view of the Charske et al. reference, US Patent No: 2,938,592.

m.) Whether claims 9, 15, 28 and 39 are unpatentable under 35 U.S.C. § 103(a) as obvious over the Brown reference (WO 01/04581).

n.) Whether claims 16-20 and 47 are unpatentable under 35 U.S.C. § 103(a) as obvious over the Brown reference (WO 01/04581) in view of the Brune et al. reference, US Patent No: 6,756,783.

o.) Whether claims 30 and 43-45 are unpatentable under 35 U.S.C. § 103(a) as obvious over the Brown reference (WO 01/04581) in view of the C.K. Woodrow (SPE/IADC 67729) reference.

p.) Whether claims 10 and 40 are unpatentable under 35 U.S.C. § 103(a) as obvious over the Brown reference (WO 01/04581) in view of the Brune et al. reference, US Patent No: 6,756,783.

q.) Whether claim 41 is unpatentable under 35 U.S.C. § 103(a) as obvious over the Brown reference (WO 01/04581) in view of the Tubel reference, US Patent No: 6,012,015.

7. ARGUMENT

a.) Rejection of claims 1 and 21 as unpatentable under 35 U.S.C. § 102(b) as anticipated by the C.K. Woodrow (SPE/IADC 67729) reference.

- Claims 1 and 21

Independent claim 1 was improperly rejected as anticipated by the C.K. Woodrow (SPE/IADC 67729) reference. The reference fails to disclose elements of the subject claims.

The C.K. Woodrow reference describes the deployment of an optical fiber distributed temperature system. The system is used to measure temperature in a well utilizing optical time domain reflectometry. As in conventional systems, however, the data is provided for manual review (see Background section of the present application). In the C.K. Woodrow reference, the temperature data "can be displayed on-site, stored for later analysis or transmitted in real-time via modem or scada/modbus links to office based engineers. The data can then be interpreted utilizing appropriate software applications." (See C.K. Woodrow reference, pg. 2, Principal of Operation). However, the cited reference fails to disclose elements of independent claim 1, and therefore the rejection under 35 USC 102(b) must be withdrawn.

For example, the C.K. Woodrow reference fails to disclose or suggest "automatically determining whether fluids are flowing into or out of a tubing located in the well by processing the temperature profile data." After a thorough search of the C.K. Woodrow reference, Appellant is unable to locate any specific teachings in which the temperature data is processed, much less, processed for automatically determining whether fluids are flowing into or out of a tubing. The Response to Arguments section of the March 6, 2008 Final Office Action, Page 9, recites that displaying the data on-site teaches the provision of the temperature profile to a processor insofar as because the data is subsequently displayed to the user, this data must be processed. However,

this contradicts teachings in the C.K. Woodrow reference which expressly refer to the data as "raw data."

As stated in the C.K. Woodrow reference, the data displayed in each of the two graphs is the raw, un-processed data extracted from the distributed temperature system. (For example, "The graph shows the raw data extracted from the distributed temperature system indicating the initial thermal profile of the wellbore (thicker line) and the various thermal profiles following initial kick-off." (C.K. Woodrow reference , pg. 3). Further, there is no automatic determining of the fluid flow into and out of the tubing. In the SPE/IADC article, an engineer is performing a manual analysis of raw data from the distributed temperature sensors. "The temperature data can be displayed on-site, stored for later analysis or transmitted in real-time via modem or scada/modbus links to office based engineers. The data can *then* be interpreted utilizing appropriate software applications." (Emphasis added). (C.K. Woodrow reference, pg. 2, Principle of Operation). As such, there is no automatic interpretation of the data. Accordingly, the C.K. Woodrow reference fails to disclose or suggest at least these elements of claim 1.

By way of further example, the C.K. Woodrow reference fails to disclose or suggest "highlighting valuable information to a user related to the flow of fluid relative to the tubing." The graph shown in Fig. 4 is manually interpreted by an engineer as showing the gaslift valves opening and closing. However, none of this information is highlighted or indicated on, for example, the graph. As a result, the C.K. Woodrow reference further fails to disclose at least this additional element of claim 1.

In the Response to Arguments section of the most recent Office Action, dated January 26, 2009, the Examiner states that the C.K. Woodrow discloses a graph "from which one can 'automatically determine' whether fluids are flowing into or out of a tubing". (See January 26, 2009 Office Action, page 23). However, this statement actually supports Appellant's argument, as set forth above, because it demonstrates that the C.K. Woodrow system requires human intervention instead of automatically determining whether fluids are flowing into or out of a tubing by processing the temperature profile data. As with other conventional systems

referenced above, human intervention is required and the determination is <u>not</u> automatic. Accordingly, due to at least these reasons, the rejection of claim 1 under 35 USC 102(b) is unsupported and should be withdrawn.

Claim 21 depends from independent claim 1 and recites additional elements. Accordingly, the present rejection of claim 21 under 35 USC 102(b) also is unsupported and should be withdrawn.

b.) Rejection of claims 1, 6-8, 14, 21-26, 29, 31, 34-38, 46 and 48 as unpatentable under 35 U.S.C. § 102(b) as anticipated by the Brown reference (WO 01/04581).

- <u>Claims 1, 6-8 and 21</u>

Independent claim 1 was improperly rejected as anticipated by the Brown reference. The reference fails to disclose elements of the subject claims.

The Brown reference describes the deployment of a fiber optic sensor system positioned along a length of conduit to determine flow rates along the conduit. For example, the Brown reference describes a method of determining mass flow rates of fluid in a conduit which is located in a heat sink that differs in temperature relative to the fluid. The mass flow rates are determined by obtaining a distributed temperature profile of fluid flowing along a length of the conduit via optical data obtained from a length of optical fiber in thermal contact with the conduit. (See page 4, lines 10-16). The flow rate data may be derived from thermal behavior of fluids that flow through massive underground formations, acting as heat sinks at their natural temperatures. As fluid flows along the conduit, the fluid is heated or cooled by conduction. (See page 8, lines 1-9). However, using changes in temperature of fluid as it flows through lengths of conduit disposed through massive underground formations having natural temperatures is substantially different than observing specific thermal events, as set forth in the subject claims of the present application.

As further taught in the Brown reference, the mass flow rate of fluid also can be determined from an analysis of the time based distributed temperature profile over the length of the conduit when the PVT characteristics of the flowing fluid are known. (See page 11, lines 19-25). In fact, the Brown reference discusses determining temperature readings at 1 meter or 10 meter intervals because the Brown system is designed to take temperature readings along a length of conduit to determine mass flow rates through the conduit rather than to detect specific thermal events as presently claimed. (see page 14, lines 9-12). On pages 15 and 16 of the Brown reference, a specific methodology is described for tracking temperatures along a conduit over time intervals to determine the flow rates Q through the tubing. However, tracking the rise and fall of temperatures due to increased and decreased flow in a conduit provides no disclosure or teaching related to detecting specific events based on the inflow/outflow of fluid, as recited in the subject claims of the present application. Accordingly, the cited reference fails to disclose elements of independent claim 1 and dependent claims 6-8, 21, and therefore the rejection under 35 USC 102(b) must be withdrawn.

For example, the Brown reference fails to disclose or suggest "automatically determining whether fluids are flowing into or out of a tubing located in the well by processing the temperature profile data" as recited in independent claim 1. In the January 26, 2009 Office Action, page 3, a statement is made that the Brown reference does teach "automatically determining whether fluids are flowing into or out of a tubing located in the well by processing the temperature profile data". However, Appellant is unable to locate any disclosure or teachings in the Brown reference in which the temperature data is processed for automatically determining whether fluids are flowing into or out of a tubing.

By way of further example, the Brown reference fails to disclose or suggest "highlighting valuable information to a user related to the flow of fluid relative to the tubing." The Brown reference provides no disclosure or teaching related to highlighting valuable information to the user related to the flow of fluid relative to the tubing, as further recited in independent claim 1. Accordingly, due to at least these reasons, the rejection of claim 1 under 35 USC 102(b) is unsupported and should be withdrawn.

Claims 6-8 and 21 ultimately depend from independent claim 1 and recite additional elements. Accordingly, the present rejection of claims 6-8 and 21 under 35 USC 102(b) also is unsupported and should be withdrawn.

- **Claim 14**

The Brown reference also fails to disclose obtaining the temperature profile data with a "temporary" distributed temperature sensor installation as recited in dependent claim 14. In the January 26, 2009 Office Action, the Brown reference is said to teach obtaining temperature profile data with a temporary distributed temperature sensor installation. However, the cited passage (column 13, lines 23-24) only discusses deploying and replacing the fiber within a deployment tube 20, if necessary.

- **Claims 22-26 and 29**

The Brown reference describes using a fiber optic sensor system to measure temperature along a conduit by deriving the thermal behavior of fluids flowing through massive underground formations which act as heat sinks, as discussed above. However, the Brown reference provides no disclosure or teaching related to a "processor being programmed to identify a particular temperature signal that corresponds to a specific downhole event" as recited in independent claim 22. As such, there is no disclosure or suggestion that "the processor outputs valuable information related to the specific downhole event to a user" as further recited in independent claim 22. For at least these reasons, the rejection of independent claim 22 under 35 USC 102(b) is unsupported and should be withdrawn.

Claims 23-26 and 29 ultimately depend from independent claim 22 and recite additional elements. Therefore, the rejection of these dependent claims under 35 USC 102(b) also should be withdrawn.

- **<u>Claims 31, 34-38, 46 and 48</u>**

The Brown reference also fails to disclose each and every element of independent claim 31. For example, the Brown reference fails to disclose or suggest "automatically processing the data to detect specific events related to heat energy in the well" and "further automatically processing the data to determine a flow rate of fluid in the well," as recited in claim 31. As described above, the Brown system determines mass flow rates by obtaining a distributed temperature profile of fluid flowing along a length of conduit via optical data obtained from a length of optical fiber in thermal contact with the conduit. (See Brown, page 4, lines 10-16). The flow rate data may be derived from thermal behavior of fluids that flow through massive underground formations, acting as heat sinks at their natural temperatures. As fluid flows along the conduit, the fluid is heated or cooled by conduction. (See Brown, page 8, lines 1-9). However, using changes in temperature of fluid as it flows through lengths of conduit disposed through massive underground formations having natural temperatures is substantially different than automatically processing the data to detect specific events related to heat energy in the well, as recited in claim 31. Accordingly, the Brown reference fails to disclose or teach elements of independent claim 31, and the rejection under 35 USC 102(b) should be withdrawn.

Claims 34-38, 46 and 48 ultimately depend from independent claim 31 and recite additional unique elements. Therefore, the rejection of these dependent claims under 35 USC 102(b) also should be withdrawn.

c.) Rejection of claims 2 and 5 as unpatentable under 35 U.S.C. § 103(a) for being obvious over the C.K. Woodrow (SPE/IADC 67729) reference in view of the Foster reference, U.S. Patent No: 3,275,980.

- **<u>Claims 2 and 5</u>**

Claims 2 and 5 were improperly rejected as obvious over the C.K. Woodrow reference in view of the Foster reference. No *prima facie* case of obviousness has been established.

Claims 2 and 5 directly depend from independent claim 1 and are patentable over the cited references for the reasons provided above with respect to independent claim 1 as well as for the additional unique subject matter recited in these dependent claims. Addition of the Foster reference does not obviate the deficiencies of the C.K. Woodrow reference to establish a *prima facie* case of obviousness. Even if the Foster reference discloses the subject matter for which it is cited, it still fails to provide the elements missing from the C.K. Woodrow reference as discussed above with reference to independent claim 1. Therefore, the rejection of dependent claims 2 and 5 under 35 USC 103(a) should be withdrawn.

d.) Rejection of claims 3 and 11 as unpatentable under 35 U.S.C. § 103(a) for being obvious over the C.K. Woodrow (SPE/IADC 67729) reference in view of the Van Bemmel et al. reference, U.S. Patent No: 6,201,884.

- **Claims 3 and 11**

Claims 3 and 11 were improperly rejected as obvious over the C.K. Woodrow reference in view of the Van Bemmel et al. reference. No *prima facie* case of obviousness has been established.

Claims 3 and 11 directly depend from independent claim 1 and are patentable over the cited references for the reasons provided above with respect to independent claim 1 as well as for the additional unique subject matter recited in these dependent claims. Addition of the Van Bemmel et al. reference does not obviate the deficiencies of the C.K. Woodrow reference to establish a *prima facie* case of obviousness. Even if the Van Bemmel et al. reference discloses the subject matter for which it is cited, it still fails to provide the elements missing from the C.K. Woodrow reference as discussed above with reference to independent claim 1. Therefore, the rejection of dependent claims 3 and 11 under 35 USC 103(a) should be withdrawn.

e.) Rejection of claim 4 as unpatentable under 35 U.S.C. § 103(a) for being obvious over the C.K. Woodrow (SPE/IADC 67729) reference in view of the Charske et al. reference, U.S. Patent No: 2,938,592.

- **Claim 4**

Claim 4 was improperly rejected as obvious over the C.K. Woodrow reference in view of the Charske et al. reference. No *prima facie* case of obviousness has been established.

Claim 4 directly depends from independent claim 1 and is patentable over the cited references for the reasons provided above with respect to independent claim 1 as well as for the additional unique subject matter recited in this dependent claim. Addition of the Charske et al. reference does not obviate the deficiencies of the C.K. Woodrow reference to establish a *prima facie* case of obviousness. Even if the Charske et al. reference discloses the subject matter for which it is cited, it still fails to provide the elements missing from the C.K. Woodrow reference as discussed above with reference to independent claim 1. Therefore, the rejection of dependent claim 4 under 35 USC 103(a) should be withdrawn.

f.) Rejection of claims 6-9 and 14 as unpatentable under 35 U.S.C. § 103(a) for being obvious over the C.K. Woodrow (SPE/IADC 67729) reference in view of the Brown reference (WO 01/04581).

- **Claims 6-9 and 14**

Claims 6-9 and 14 were improperly rejected as obvious over the C.K. Woodrow reference in view of the Brown reference. No *prima facie* case of obviousness has been established.

Claims 6-9 and 14 ultimately depend from independent claim 1 and are patentable over the cited references for the reasons provided above with respect to independent claim 1 as well as for the additional unique subject matter recited in these dependent claims. Addition of the

Brown reference does not obviate the deficiencies of the C.K. Woodrow reference to establish a *prima facie* case of obviousness. Even if the Brown reference discloses the subject matter for which it is cited, it still fails to provide the elements missing from the C.K. Woodrow reference as discussed above with reference to independent claim 1. Therefore, the rejection of dependent claims 6-9 and 14 under 35 USC 103(a) should be withdrawn.

g.) Rejection of claim 15 as unpatentable under 35 U.S.C. § 103(a) for being obvious over the C.K. Woodrow (SPE/IADC 67729) reference.

- **Claim 15**

Claim 15 was improperly rejected as obvious over the C.K. Woodrow reference. No *prima facie* case of obviousness has been established.

Claim 15 directly depends from independent claim 1 and is patentable over the cited references for the reasons provided above with respect to independent claim 1 as well as for the additional unique subject matter recited in this dependent claim. The C.K. Woodrow reference provides no additional teaching sufficient to establish a prima facie case of obviousness with respect to a claim that depends from independent claim 1. Therefore, the rejection of dependent claim 15 under 35 USC 103(a) should be withdrawn.

h.) Rejection of claims 16-20 as unpatentable under 35 U.S.C. § 103(a) for being obvious over the C.K. Woodrow (SPE/IADC 67729) reference in view of the Brune et al. reference, US Patent No: 6,756,783.

- **Claims 16-20**

Claims 16-20 were improperly rejected as obvious over the C.K. Woodrow reference in view of the Brune et al. reference. No *prima facie* case of obviousness has been established.

Claims 16-20 ultimately depend from independent claim 1 and are patentable over the cited references for the reasons provided above with respect to independent claim 1 as well as for the additional unique subject matter recited in these dependent claims. Addition of the Brune et al. reference does not obviate the deficiencies of the C.K. Woodrow reference to establish a *prima facie* case of obviousness. Even if the Brune et al. reference discloses the subject matter for which it is cited, it still fails to provide the elements missing from the C.K. Woodrow reference as discussed above with reference to independent claim 1. Therefore, the rejection of dependent claims 16-20 under 35 USC 103(a) should be withdrawn.

i.) Rejection of claims 10 and 40 as unpatentable under 35 U.S.C. § 103(a) for being obvious over the C.K. Woodrow (SPE/IADC 67729) reference in view of the Brown reference (WO 01/04581) and in view of the Brune et al. reference, U.S. Patent No: 6,756,783.

- Claims 10 and 40

Independent claims 10 and 40 were improperly rejected under 35 U.S.C. §103(a) over the C.K. Woodrow reference in view of the Brown reference and the Brune et al. reference. The combination of references fails to establish a *prima facie* case of obviousness, and therefore the rejection must be withdrawn.

As discussed generally above, both the C.K. Woodrow reference and the Brown reference fail to disclose or teach automatically processing data to detect specific events related to heat energy in a well as recited in independent claim 40. Addition of the Brune et al. reference fails to obviate the deficiencies of disclosure with respect to the C.K. Woodrow and Brown references. Accordingly, no prima facie case of obviousness can be established with respect independent claim 40.

The combination of references further fails to disclose, teach or suggest various elements of independent claim 10 or independent claim 40. According to the January 26, 2009 Office

Action, the C.K. Woodrow reference "fails to explicitly teach wherein the automatically determining comprises applying a model-fitting algorithm to the data has claimed within both claims 10 and 40." (See January 26, 2009 Office Action, page 13). Furthermore, the Brown reference is characterized as "silent to the construction of a match filter, and, further, wherein constructing the match filter comprises incorporating modifications to the filter to make it orthogonal to background trends." (See January 26, 2009 Office Action, page 14). Consequently, the Brune et al. reference is cited and relied on as providing "a calibration procedure wherein orthogonal axes can be located and data obtained can be transformed mathematically into any desired direction (col. 15, l. 15-40)." (See January 26, 2009 Office Action, page 14).

Appellant strongly disagrees with the characterization of the cited references provided in the January 26, 2009 Office Action. For example, the Brune et al. reference describes a boring system 10 having a boring tool 16 on the end of a drill string 18. The boring tool 16 has a dipole transmitter 20 with an antenna 22 to transmit a dipole locating field 24. (See column 7, lines 7-17). The Brune et al. methodology involves a ground calibration procedure that provides dipole signal strength and also yields a value for skin depth in the drilling region. (See column 14, lines 60-64). The calibration procedure is performed with a walkover locator at two offset positions along an x axis. In one example, the walkover locator has an antenna aligned parallel to the y axis of the transmitter. Furthermore, when the locating field detector includes three orthogonal receiving axes, the detector arrangement is stated to be "somewhat arbitrary since signals measured along the three axes can be transformed mathematically into any desired directions." (See column 15, lines 15-17 and lines 29-39).

However, this description of a field detector used in a system for operating a boring tool cannot be construed as disclosing, teaching or suggesting: automatically processing a temperature profile through application of a model-fitting algorithm by "constructing a match filter, further wherein constructing the match filter comprises incorporating modifications to the filter to make it orthogonal to background trends" as recited in independent claim 10. Similarly, the description cannot be construed as disclosing, teaching or suggesting: automatically processing data on

specific events related to heat energy in a well by applying a model-fitting algorithm that comprises "constructing a match filter and using extrema of a convolution of the filter with data to select candidate depths, wherein constructing the match filter comprises incorporating modifications to the filter to make it orthogonal to background trends" as recited in independent claim 40. Neither the Brune et al. reference nor the other cited references disclose, teaches or suggests these elements. Accordingly, no prima facie case of obviousness can be established, and the rejection of claims 10 and 40 under 35 USC 103(a) must be withdrawn.

Appellant also disagrees with the characterization of the C.K. Woodrow and Brown references. Furthermore, Appellant submits the disparate teachings of the C.K. Woodrow reference and Brown reference relative to the Brune et al. reference renders the combination of these references improper under 35 USC 103(a). However, because the cited references fail to disclose or suggest elements of the subject claims, Appellant believes it is unnecessary to currently discuss whether the references have been properly combined. Again, no *prima facie* case of obviousness has been established, and the rejection under 35 USC 103(a) should be withdrawn.

j.) Rejection of claims 2 and 5 as unpatentable under 35 U.S.C. § 103(a) for being obvious over the Brown reference (WO 01/04581) in view of the Foster reference, U.S. Patent No: 3,275,980.

- **Claims 2 and 5**

Claims 2 and 5 were improperly rejected as obvious over the Brown reference in view of the Foster reference. No *prima facie* case of obviousness has been established.

Claims 2 and 5 directly depend from independent claim 1 and are patentable over the cited references for the reasons provided above with respect to independent claim 1 as well as for the additional unique subject matter recited in these dependent claims. Addition of the Foster reference does not obviate the deficiencies of the Brown reference to establish a *prima facie* case

of obviousness. Even if the Foster reference discloses the subject matter for which it is cited, it still fails to provide the elements missing from the Brown reference as discussed above with reference to independent claim 1. Therefore, the rejection of dependent claims 2 and 5 under 35 USC 103(a) should be withdrawn.

k.) Rejection of claims 3 and 11 as unpatentable under 35 U.S.C. § 103(a) for being obvious over the Brown reference (WO 01/04581) in view of the Van Bemmel et al. reference, U.S. Patent No: 6,201,884.

- Claims 3 and 11

Claims 3 and 11 were improperly rejected as obvious over the Brown reference in view of the Van Bemmel et al. reference. No *prima facie* case of obviousness has been established.

Claims 3 and 11 directly depend from independent claim 1 and are patentable over the cited references for the reasons provided above with respect to independent claim 1 as well as for the additional unique subject matter recited in these dependent claims. Addition of the Van Bemmel et al. reference does not obviate the deficiencies of the Brown reference to establish a *prima facie* case of obviousness. Even if the Van Bemmel et al. reference discloses the subject matter for which it is cited, it still fails to provide the elements missing from the Brown reference as discussed above with reference to independent claim 1. Therefore, the rejection of dependent claims 3 and 11 under 35 USC 103(a) should be withdrawn.

l.) Rejection of claim 4 as unpatentable under 35 U.S.C. § 103(a) for being obvious over the Brown reference (WO 01/04581) in view of the Charske et al. reference, U.S. Patent No: 2,938,592.

- Claim 4

Claim 4 was improperly rejected as obvious over the Brown reference in view of the Charske et al. reference. No *prima facie* case of obviousness has been established.

Claim 4 directly depends from independent claim 1 and is patentable over the cited references for the reasons provided above with respect to independent claim 1 as well as for the additional unique subject matter recited in this dependent claim. Addition of the Charske et al. reference does not obviate the deficiencies of the Brown reference to establish a *prima facie* case of obviousness. Even if the Charske et al. reference discloses the subject matter for which it is cited, it still fails to provide the elements missing from the Brown reference as discussed above with reference to independent claim 1. Therefore, the rejection of dependent claim 4 under 35 USC 103(a) should be withdrawn.

m.) Rejection of claims 9, 15, 28 and 39 as unpatentable under 35 U.S.C. § 103(a) for being obvious over the Brown reference (WO 01/04581).

- **Claims 9, 15, 28 and 39**

Claims 9, 15, 28 and 39 were improperly rejected as obvious over the Brown reference. No *prima facie* case of obviousness has been established.

Claims 9, 15, 28 and 39 ultimately depend from one of the independent claims 1, 22 or 31 and are patentable over the cited references for the reasons provided above with respect to their corresponding independent claims as well as for the additional unique subject matter recited in these dependent claims. The Brown reference provides no additional disclosure or teaching that would obviate its deficiencies as discussed above with respect to the corresponding independent claims 1, 22 and 31. Therefore, the rejection of dependent claims 9, 15, 28 and 39 under 35 USC 103(a) should be withdrawn.

n.) Rejection of claims 16-20 and 47 as unpatentable under 35 U.S.C. § 103(a) for being obvious over the Brown reference (WO 01/04581) in view of the Brune et al. reference, US Patent No: 6,756,783.

- **<u>Claims 16-20 and 47</u>**

Claims 16-20 and 47 were improperly rejected as obvious over the Brown reference in view of the Brune et al. reference. No *prima facie* case of obviousness has been established.

Claims 16-20 and 47 ultimately depend from one of the independent claims 1 or 31 and are patentable over the cited references for the reasons provided above with respect to independent claims 1 and 31 as well as for the additional unique subject matter recited in these dependent claims. Addition of the Brune et al. reference does not obviate the deficiencies of the Brown reference to establish a *prima facie* case of obviousness. Even if the Brune et al. reference discloses the subject matter for which it is cited, it still fails to provide the elements missing from the Brown reference as discussed above with reference to independent claims 1 and 31. Therefore, the rejection of dependent claims 16-20 and 47 under 35 USC 103(a) should be withdrawn.

o.) Rejection of claims 30 and 43-45 as unpatentable under 35 U.S.C. § 103(a) for being obvious over the Brown reference (WO 01/04581) in view of the C.K. Woodrow (SPE/IADC 67729) reference.

- **<u>Claims 30 and 43-45</u>**

Claims 30 and 43-45 were improperly rejected as obvious over the Brown reference in view of the C.K. Woodrow reference. No *prima facie* case of obviousness has been established.

Claims 30 and 43-45 ultimately depend from one of the independent claims 22 or 31 and are patentable over the cited references for the reasons provided above with respect to

independent claims 22 and 31 as well as for the additional unique subject matter recited in these dependent claims. Addition of the C.K. Woodrow reference does not obviate the deficiencies of the Brown reference to establish a *prima facie* case of obviousness. Even if the C.K. Woodrow reference discloses the subject matter for which it is cited, it still fails to provide the elements missing from the Brown reference as discussed above with reference to independent claims 1 and 31. Therefore, the rejection of dependent claims 30 and 43-45 under 35 USC 103(a) should be withdrawn.

p.) Rejection of claims 10 and 40 as unpatentable under 35 U.S.C. § 103(a) for being obvious over the Brown reference (WO 01/04581) and in view of the Brune et al. reference, U.S. Patent No: 6,756,783.

- Claims 10 and 40

Independent claims 10 and 40 were rejected under 35 U.S.C. §103(a) under the Brown reference in view of the Brune et al. reference. This rejection is respectfully traversed. The combination of references fails to establish a *prima facie* case of obviousness, and therefore the rejection must be withdrawn.

As discussed generally above, the Brown reference fails to disclose or teach automatically processing data to detect specific events related to heat energy in a well as recited in independent claim 40. Addition of the Brune et al. reference fails to obviate the deficiencies of disclosure with respect to the Brown reference. Accordingly, no prima facie case of obviousness can be established with respect independent claim 40.

The combination of references further fails to disclose, teach or suggest various elements of independent claim 10 or independent claim 40. According to the January 26, 2009 Office Action, the Brown reference is characterized as "silent to the construction of a match filter, and, further, wherein constructing the match filter comprises incorporating modifications to the filter to make it orthogonal to background trends." (See January 26, 2009 Office Action, page 21).

Consequently, the Brune et al. reference is cited and relied on to provide these elements. (See January 26, 2009 Office Action, pages 21-22).

Appellant strongly disagrees with the characterization of the cited references provided in the January 26, 2009 Office Action. As discussed above, the Brune et al. reference describes a boring system 10 having a boring tool 16 decision on the end of a drill string 18. The boring tool 16 has a dipole transmitter 20 with an antenna 22 to transmit a dipole locating field 24. (See column 7, lines 7-17). The Brune et al. methodology involves a ground calibration procedure that provides dipole signal strength and also yields a value for skin depth in the drilling region. (See column 14, lines 60-64). The calibration procedure is performed with a walkover locator at two offset positions along an x axis. In one example, the walkover locator has an antenna aligned parallel to the y axis of the transmitter. Furthermore, when the locating field detector includes three orthogonal receiving axes, the detector arrangement is stated to be "somewhat arbitrary since signals measured along the three axes can be transformed mathematically into any desired directions." (See column 15, lines 15-17 and lines 29-39).

However, this description of a field detector used in a system for operating a boring tool cannot be construed as disclosing, teaching or suggesting: automatically processing a temperature profile through application of a model-fitting algorithm by "constructing a match filter, further wherein constructing the match filter comprises incorporating modifications to the filter to make it orthogonal to background trends" as recited in independent claim 10. Similarly, the description cannot be construed as disclosing, teaching or suggesting: automatically processing data on specific events related to heat energy in a well by applying a model-fitting algorithm that comprises "constructing a match filter and using extrema of a convolution of the filter with data to select candidate depths, wherein constructing the match filter comprises incorporating modifications to the filter to make it orthogonal to background trends" as recited in independent claim 40. The Brune et al. reference, even when combined with the Brown reference, fails to disclose, teach or suggest these elements. Accordingly, no prima facie case of obviousness can be established, and the rejection of claims 10 and 40 under 35 USC 103(a) must be withdrawn.

Appellant further disagrees with the characterization of the Brown reference and also submits that the disparate teachings of the Brown reference relative to the Brune et al. reference renders the combination of these references improper under 35 USC 103(a). However, because the cited references fail to disclose or suggest elements of the subject claims, Appellant believes it is unnecessary to discuss whether the references have been properly combined at this time. Again, no *prima facie* case of obviousness has been established, and the rejection under 35 USC 103(a) should be withdrawn.

q.) Rejection of claim 41 as unpatentable under 35 U.S.C. § 103(a) for being obvious over the Brown reference (WO 01/04581) in view of the Tubel reference, US Patent No: 6,012,015.

- <u>Claim 41</u>

Claim 41 was improperly rejected as obvious over the Brown reference in view of the Tubel reference. No *prima facie* case of obviousness has been established.

Claim 41 directly depends from independent claim 31 and is patentable over the cited references for the reasons provided above with respect to independent claim 31 as well as for the additional unique subject matter recited in dependent claim 41. Addition of the Tubel reference does not obviate the deficiencies of the Brown reference to establish a *prima facie* case of obviousness. Even if the Tubel reference discloses the subject matter for which it is cited, it still fails to provide the elements missing from the Brown reference as discussed above with reference to independent claim 31. Therefore, the rejection of dependent claim 41 under 35 USC 103(a) should be withdrawn.

In view of the above remarks, Applicant respectfully submits the Examiner has provided no supportable position or evidence that any of the claims 1-11, 14-31, 34-41 and 43-48 is anticipated under 35 U.S.C. § 102(b) or obvious under 35 U.S.C. § 103(a). Accordingly, Applicant respectfully requests that the Board find claims 1-11, 14-31, 34-41

and 43-48 patentable over the art of record, withdraw all outstanding rejections, and allow claims 1-11, 14-31, 34-41 and 43-48.

An Appeal Brief fee in the amount of $510 was previously paid with the Appeal Brief mailed on July 30, 2008. A payment in the amount of $30 is provided on the attached form PTO-2038 to cover the difference between the previously paid Appeal Brief fee of $510 and the current Appeal Brief fee of $540. However, if the amount listed thereon is insufficient, or if the amount is unable to be charged to the credit card for any other reason, the Commissioner is authorized to charge Deposit Account No. 50-3054.

Respectfully submitted,

Date: June 15, 2009

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8. <u>CLAIMS APPENDIX</u>

1. A method for analyzing distributed temperature data from a well comprising:

   using a distributed temperature sensor system to obtain temperature profile data along a portion of a wellbore;

   providing the temperature profile data to a processor;

   automatically determining whether fluids are flowing into or out of a tubing located in the well by processing the temperature profile data; and

   highlighting valuable information to a user related to the flow of fluid relative to the tubing.

2. The method as recited in claim 1, wherein automatically determining comprises removing noise from the temperature profile data.

3. The method as recited in claim 1, wherein automatically determining comprises removing low order spatial trends.

4. The method as recited in claim 1, wherein automatically determining comprises utilizing a high-pass filter.

5. The method as recited in claim 1, wherein automatically determining comprises utilizing a low-pass filter.

6. The method as recited in claim 1, wherein automatically determining comprises applying a model-fitting algorithm to the data.

7. The method as recited in claim 6, wherein applying a model-fitting algorithm comprises selecting regions for fitting and fitting a model to data.

8. The method as recited in claim 7, wherein applying a model-fitting algorithm further comprises testing results for statistical significance.

9. The method as recited in claim 6, wherein applying a model-fitting algorithm comprises constructing a match filter and using extrema of a convolution of the filter with data to select candidate depths.

10. A method for analyzing distributed temperature data from a well, comprising:

obtaining temperature profile data along a portion of a wellbore;

providing the temperature profile data to a processor; and

automatically processing the temperature profile data to highlight valuable information to a user, wherein automatically processing comprises applying a model-fitting algorithm to the data and applying the model-fitting algorithm comprises constructing a match filter, further wherein constructing the match filter comprises incorporating modifications to the filter to make it orthogonal to background trends.

11. The method as recited in claim 1, wherein automatically determining comprises trend removal and filtering of the temperature profile data.

14. The method as recited in claim 1, wherein using comprises obtaining the temperature profile data with a temporary distributed temperature sensor installation.

15. The method as recited in claim 1, wherein using comprises obtaining the temperature profile data with a slickline distributed temperature sensing system.

16. The method as recited in claim 1, wherein automatically determining comprises utilizing a match filter.

17. The method as recited in claim 16, wherein the match filter is used to detect particular temperature signals corresponding to a particular downhole event.

18. The method as recited in claim 17, wherein the downhole event comprises the location of a gas lift valve.

19. The method as recited in claim 17, wherein the downhole event comprises a hole in a tubing.

20. The method as recited in claim 17, wherein the downhole event comprises a leak in a wellbore completion tool.

21. The method as recited in claim 1, wherein the automatically determining occurs in real-time with the obtaining data.

22. A system to analyze distributed temperature data from a well, comprising:

a distributed temperature sensor that measures temperature profile data along a portion of a wellbore;

a processor that receives the temperature profile data in real time, the processor being programmed to identify a particular temperature signal that corresponds to a specific downhole event having an inflow of relatively cooler fluid; and

wherein the processor outputs valuable information related to the specific downhole event to a user.

23. The system as recited in claim 22, wherein the distributed temperature system comprises an optical fiber.

24. The system as recited in claim 22, wherein the distributed temperature sensor comprises an opto-electronic unit to launch optical pulses downhole.

25. The system as recited in claim 24, wherein the opto-electronic unit is coupled to the processor by a communication link.

26. The system as recited in claim 25, wherein the communication link comprises a hardline link.

27. The system as recited in claim 25, wherein the communication link comprises a wireless link.

28. The system as recited in claim 22, wherein the processor is embodied in a portable computer.

29. The system as recited in claim 23, further comprising a production tubing deployed in the wellbore with the optical fiber.

30. The system as recited in claim 29, wherein the production tubing is combined with a gas lift system.

31. A method of detecting certain events within a well, comprising:

using a distributed temperature sensor system to obtain data related to temperature over a period of time along a portion of a wellbore;

automatically processing the data to detect specific events related to heat energy in the well;

further automatically processing the data to determine a flow rate of fluid in the well; and

displaying results to a user.

34. The method as recited in claim 31, wherein automatically processing comprises processing the data on a processor-based computer.

35. The method as recited in claim 31, wherein automatically processing comprises processing backscattered light signals.

36. The method as recited in claim 31, wherein automatically processing comprises applying a model-fitting algorithm to the data.

37. The method as recited in claim 36, wherein applying a model-fitting algorithm comprises selecting regions for fitting and fitting a model to data.

38. The method as recited in claim 37, wherein applying a model-fitting algorithm further comprises testing results for statistical significance.

39. The method as recited in claim 36, wherein applying a model-fitting algorithm comprises constructing a match filter and using extrema of a convolution of the filter with data to select candidate depths.

40. A method of detecting certain events within a well, comprising:

obtaining data over a period of time along a portion of a wellbore;

automatically processing the data to detect specific events related to heat energy in the well; and

displaying results to a user, wherein automatically processing comprises applying a model-fitting algorithm to the data and applying the model-fitting algorithm comprises constructing a match filter and using extrema of a convolution of the filter with data to select candidate depths, wherein constructing the match filter comprises incorporating modifications to the filter to make it orthogonal to background trends.

41. The method as recited in claim 31, wherein automatically processing comprises applying a phenomenological model to the data.

43. The method as recited in claim 31, wherein automatically processing comprises detecting particular temperature signals corresponding to location of a gas lift valve.

44. The method as recited in claim 31, wherein automatically processing comprises detecting particular temperature signals corresponding to a wellbore completion tool leak.

45. The method as recited in claim 31, wherein automatically processing comprises detecting particular temperature signals corresponding to a hole in a production tubing.

46. The method as recited in claim 31, wherein displaying comprises displaying results in graphical form on a display monitor.

47. The method as recited in claim 31, wherein automatically processing comprises utilizing a match filter.

48. The method as recited in claim 31, wherein automatically processing occurs real-time with the obtaining data.

9. **<u>EVIDENCE APPENDIX</u>**

Not Applicable

10. **<u>RELATED PROCEEDINGS APPENDIX</u>**

Not Applicable